Driver Aggression as a Function of Status Concurrence: An Analysis of Horn-Honking Responses

(research report)

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Abstract

Various field experiments [illegible] onducted to examine the influence of social status on aggression in road traffic. H[illegible] king response times of subjects blocked by an experimental car at traffic lights were co[illegible] to be an indicator of the degree of aggression. During an initial experiment, the statu[illegible] *rustrator* was varied and an inverse relation was observed between status and aggres[illegible] ards the frustrator. On the other hand, in a more recent experiment higher status *ag*[illegible] were found to behave more aggressively. In our study we combined the two designs[illegible] varied the status of the frustrator and at the same time measured the status of th[illegible] sor. Neither results of the former experiments could be replicated, but we observe[illegible] tion in aggression when frustrator and aggressor were of similar social status.

I. Introduction

Doob and Gross (1968) measured horn-honking response times as an indicator of aggression of car drivers when blocked by an experimental car at traffic lights in the United States (N=74). They used two blocking cars indicating different levels of social status. As response times were significantly shorter and responses occurred significantly more frequently when a driver was frustrated (i.e. blocked) by a lower class automobile, Doob and Gross concluded that the status of frustrator and aggression towards the frustrator are inversely related. Deaux (1971) found a similar (non-significant) effect in a replication of the experiment.[1] Furthermore, in a study by McGarva and Steiner (2000) drivers responded more aggressively to provocation by a low status driver than to provocation by a high status driver.

On the other hand Diekmann, Jungbauer-Gans, Krassnig, and Lorenz conducted an experiment to explore "… the effect of the social status of a frustrated person on the tendency to react in an aggressive manner" (1996, p. 761). Again, drivers were blocked at traffic lights (this time in Germany, N=57) and horn-honking response times were recorded. However, instead of varying the status of the blocking car (frustrator) the status of the blocked car (aggressor) was measured. In the study by Diekmann et al. a positive relationship was found between the status of the aggressor and the degree of aggression (with the exception of the lowest class aggressors who acted fairly aggressively, too).

[1] However, in an Australian replication by Bochner (1971) no relationship was measured between the (rather unconventionally indicated) status of the frustrator and horn-honking latencies. Chase and Mills (1973) even found an effect pointing in the opposite direction. In their replication of the experiment in the United States the higher status frustrator elicited significantly faster horn-honking responses than the lower status frustrator.

To summarize, the results of the study by Doob and Gross (1968) and the study by Diekmann et al. (1996) are as follows: On the one hand, low status blocking objects elicited faster reactions and thus higher levels of aggression than did high status frustrators. On the other hand, high status aggressors reacted faster to a blocking object than did low status aggressors. In our study, we now investigate a possible interaction effect between the status of the frustrator and the status of the aggressor. We assume that the *similarity* (or difference, respectively) of the status of the actors determines the aggressiveness of behaviour rather than the status of one or the other per se. To speak in terms of Game Theory, we assume that the *disposition to cooperate* is generally higher between subjects of similar social status and thus—if we view cooperation as the suppression of aggression—lower degrees of aggression should be observed in such cases.

In order to show "… just how minimal a degree of similarity between two people is necessary for them to have a sense of 'belonging together'" Miller, Downs, and Prentice (1998, p. 475) had subjects play prisoners dilemma games against fictitious subjects sharing the same birthday. They found a clear increase of the level of cooperation compared to the control group of non-birthday mates. Furthermore, research on social categorization and intergroup behaviour (Tajfel, Billig, Bundy, & Flament, 1971; Billig & Tajfel, 1973; Turner, Brown, & Tajfel, 1979; Tajfel, 1978, 1982a, 1982b; Mummendey & Schreiber, 1983; Brewer & Kramer, 1985; Robinson, 1996, to name just a few) revealed a strong bias towards favouring the in-group in many contexts—importantly, even "… in the absence of comparison with any other groups" (Brewer, 1979, p. 321; also see Kramer & Brewer, 1986). Grzelak—in an introductory textbook on social psychology—hits the spot, writing: "… there are grounds for expecting that the number and strength of real-life conflicts can be substantially reduced when the participants are willing and able to find any cues, any reason to think of the other(s) as belonging to the same category, sharing the same fate, and thus being true partners rather than opponents" (1988, p. 310). Thus, we hypothesize that in cases of status concurrence less aggressive behaviour, i.e. slower honking reactions, are to be expected and vice versa—in particular because social status presumably is a rather strong determinant of social cohesion (Hechter, 1987, p. 176). Presupposed assumptions are, of course, that the car driven by a subject serves—at least to some degree—as a means of expression of the subjects' social status (Marsh & Collett, 1986, leave no doubt in this regard), and that other subjects also perceive the social status expressed by means of a car (this seems reasonable, too, since Knapper & Cropley, 1980, show that the perception and interpretation of the other drivers characteristic is usually quite vivid).

II. Method

In order to test our hypothesis we blocked cars at traffic lights using an experimental car and measured horn-honking response times in a similar manner to Doob and Gross (1968). Despite the concerns expressed by some authors about the validity of horn-honking latencies as a measure of aggression (McGarva & Steiner, 2000; Ellison-Potter, Bell, & Deffenbacher, 2001) the method has proven to be quite useful to study aggressive behaviour in a naturalistic setting (also see Baron, 1976, p. 272, who provides evidence that "… it seems reasonable to view horn-honking as an aggressive response …"). Besides the already mentioned (Doob and Gross, 1968; Deaux, 1971; Bochner, 1971; Chase and Mills, 1973; Diekmann et al., 1996) quite a few horn-honking experiments have been realized in past. Forgas (1976) studied reactions to national stereotypes in Europe, Turner, Layton, and Simons (1975) studied the influence of victim visibility and aggressive stimuli, Ellison, Govern, Petri, and Figler (1995) the influence of subject anonymity, McDonald and Wooten (1988) and Baron (1976) the influence of incompatible responses, and Baron (1976) as well as Kenrick and MacFarlane (1986) the influence of ambient temperature. Furthermore, Shinar (1998) used the method to study the influence of various situational factors on aggressive driving.

After carrying out a pre-test, our experiment was conducted on two consecutive Saturday mornings in spring 1995 at an intersection with relatively light traffic in Bern, Switzerland. On the first day we used an experimental car indicating high social status and on the second, a car indicating low social status.[2] Traffic conditions were similar on both mornings, but the weather was slightly nicer the first day. An experimental trial was carried out if the experimental car could be stopped in the front position at the red light and if just one car was following.[3] After the light turned green, the experimental car remained stopped until the first honking response occurred from the car behind. Inside the experimental car were a driver and two observers, all male. One observer measured the time between the light changing and the honking response. Using the mirrors, the other observer took down some information about the blocked subject, including sex and estimated age of the driver, as well as make, model, and status (classified into three hierarchical categories) of the vehicle. If a blocked subject did not respond within the 12-second period of the green light the case was taken down as censored at t = 12. All in all we observed 123 valid cases, approximately 60 on each morning, of which 26 were censored.

Since there are censored response times, the techniques of event history modeling are the most appropriate statistical tools for analyzing the data (Diekmann et al., 1996, p. 763). We will use the product-limit method to estimate median response times as descriptive measures.

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[2] The experimental cars used were a black 1995 Audi A6 2.6L as high status car and a blue 1989 Volkswagen Golf C1 Mark III as low status car.

[3] The presence of other drivers may influence horn-honking behaviour (even though Lajunen, Parker, & Summala, 1999, did not find any relation between exposure to traffic congestion and driver aggression). At least, Yinon and Levian (1995) have shown that the presence of drivers behind or aside increases the frequency of traffic violations. Additionally, Baxter et al. (1990) provide evidence that the presence of passengers has effects on driver behaviour. Unfortunately, this has not been controlled for in our experiment.

Multivariate analysis will be conducted via the semi-parametric Cox regression model (Cox, 1972; Blossfeld & Rohwer, 1995; Diekmann & Mitter, 1984).[4] In the Cox model, the hazard rate $r(t)$ of horn-honking—i.e. the probability of a horn-honking event at time t conditional to the fact that the event had not yet occurred—is specified as

$$r(t) = h(t)\exp(\beta X)$$

where $h(t)$ is an unspecified baseline hazard rate and X is a covariate vector. The parameter vector β is the vector of the (proportional) effects of the covariates on $r(t)$. In the following analysis we will report the *exponents* of the estimates of β since they can be interpreted straightforwardly as multiplication effects on $r(t)$, i.e. as hazard ratios. The Cox regression assumes proportional hazards at each point in time. Departure from this assumption has been tested and found to be negligible for the following models.

III. Results

Table 1 shows the median response times by status of frustrator and aggressor. As one can see, the results of Doob and Gross (1968) and Diekmann et al. (1996) could not be replicated. First, there is no increase in median response time for higher status frustrators (bottom row of table

[4] Among a number of parametric models (exponential, Gompertz, Weibull, log-logistic, log-normal, and sickle) the Weibull model was found to fit our data best (interestingly, estimation is pointing towards a linearly increasing hazard rate over time). However, the results do not significantly defer from the results of the Cox regression and, therefore, we will not report them.

1).[5] Secondly, no decrease in response times can be observed for higher status aggressors (last column of table 1).

[Table 1 about here]

However, if looking at the first and second column of table 1, one can find some evidence for our hypothesis about an interaction between the status of the frustrator and the status of the aggressor. In the case of the lower status frustrator, the highest status aggressors showed the most aggressive behaviour and in the case of the higher status experimental car, the lowest status aggressors had the fastest median response time.

Since the median estimators are not very robust for small case numbers and because controls should be carried out for third variables (the assignment of the status of the aggressors is non-random and, therefore, may depend upon variables such as sex or age), we further analyze the data by estimation of multivariate Cox regression models. Model 1 in table 2 is designed to test the status effects reported by Doob and Gross (1968) and Diekmann et al. (1996). Again, these effects are clearly not supported by our data. Our estimates even point in the opposite direction (although not significantly): higher status frustrators elicited faster horn-honking reactions than lower status frustrators (approx. 20 % increase of the hazard rate) and middle and higher status

[5] The lack of this effect *might* be due to different weather conditions. As mentioned, weather was somewhat nicer, i.e. warmer, on the first day when the high status condition was employed. In line with Kenrick and MacFarlane (1986) as well as Baron (1976), who have shown that temperature has a strong effect on horn-honking behaviour (for an overview see Anderson, 1989), one would expect faster horn honking reactions on warmer days. This could have ironed out the status effect of the frustrator. Nonetheless, our hypothesis of an interaction between the status of the frustrator and the status of the aggressor should still be testable.

aggressors behaved less aggressively than lower status aggressors (21 % and 38 % decrease of the hazard rate, respectively).

[Table 2 about here]

To test the hypothesis of less aggressive behaviour in the case of similar status between frustrator and aggressor, we introduced two dummy-variables measuring the degree of status difference in model 2 (small difference: middle status aggressor and lower or higher status frustrator, respectively; large difference: lower status frustrator and higher status aggressor or vice versa). As expected, differences in status between frustrator and aggressor increase the hazard rate of horn-honking by quite a margin (approximately 40 % in the case of a small status difference and 100 % in the case of a large status difference). Since the null-hypothesis of a linear effect of the status difference—i.e., that the log of the hazard ratio for a small difference is exactly half of the log of the ratio for a large difference—cannot be rejected (Wald test: χ^2 (1) = 0.02, p = 0.89), we might as well proceed with the more efficient model 3 (where the difference in status is coded as follows: 0 = no difference; 1 = small difference; 2 = large difference). Again we observe a significant status dissimilarity effect, i.e., the greater the difference in status between frustrator and aggressor the higher the hazards of horn-honking or, to put it the other way round, the greater the similarity in status the slower the horn-honking responses.[6]

[6] Our model assumes a symmetric effect, i.e., that a certain absolute difference in status—regardless if positive or negative—always has the same effect. To loosen this assumption we also tested a possible interaction between the status of the frustrator and status difference, i.e. the effect of a positive versus a negative difference. Although quite substantial (the effect was stronger in the case of a negative status difference, i.e., if the status of the frustrator was higher than the status of the aggressor) the interaction term has not proven to be significant.

Furthermore, there is also a gender effect (although not clearly significant): the hazard rate for female drivers was 36% below the rate for male drivers. This is in accordance with the findings of Doob and Gross (1968) and Shinar (1998, pp. 149-150; also see Ellison-Potter et al., 2001, who found males to behave more aggressively in a driving simulation task). However, in several replications of the horn-honking experiment (Deaux, 1971; Chase & Mills, 1973; Turner et al., 1975; Forgas, 1976; Kenrick & MacFarlane, 1986; Ellison et al., 1995; Diekmann et al., 1996; Shinar, 1998, pp. 151-156) the effect of the sex of the aggressor—although pointing in the right direction most of the time—has not been significant. Taken all together, we conclude that gender is most likely to have an effect on "mild driver aggression" such as horn-honking, but the effect is small and possibly depends on situational factors such as, e.g., the sex of the frustrator or the presence and characteristics of passengers. According to Hennessy and Wiesenthal (2001) a more distinct difference between men and women may be expected in the case of "driver violence", i.e. more severe forms of behaviour such as chasing other drivers or vandalizing vehicles.

Finally, young and—rather oddly—old drivers responded more aggressively. But, since we had no elaborated expectations with regard to age, we do not want to stress its interpretation here. Thinking of the stereotype of aggressive young male drivers, one could possibly expect interaction effects between sex and age (cf. Shinar, 1998; Hauber, 1980; Richman, 1972). However, we could not find any such relation (not shown).

IV. Conclusion

The results of our experiment provide evidence that similarity in social status between two actors can, in effect, reduce the degree of aggression expressed in real life interaction. Latencies of horn-honking responses were significantly higher in cases where the driver of a car was blocked by an experimental car of similar status than in cases where the statuses of the two cars were clearly different. Our data, however, do not reveal whether it is actually *similarity* which *reduces* aggression or rather *difference* which *increases* it.

A closer look at the results of the study of Diekmann et al. (1996) reveals that they are quite well in accordance with our findings (without being proof of our hypothesis). The experimental car used to block the intersection by Diekmann et al. was classified as "lower middle class", the class of aggressors who showed the lowest level of aggression in their experiment (while the level of aggression increased monotonically for higher status classes, it was also higher in the remaining lower class). Furthermore, our findings can even contribute to an explanation of the controversial results of the studies where only the status of the frustrator has been varied. According to our hypothesis the results of such experiments depend on the composition of the sample of blocked subjects. If there are lots of high status subjects in the sample, e.g., because the experiment has been conducted in a rather wealthy area, one would expect a lower status frustrator to elicit more aggressive responses than a higher status frustrator, just as observed by Doob and Gross (1968) and Deaux (1971). On the other hand, if there are many low status subjects, one would expect more aggressive responses in the case of a higher status frustrator, as reported by Chase and Mills (1973). Unfortunately, these studies do not provide any such information on the composition of the sample.

Our findings are supported by a study by Miller et al. (1998) in which similarity between actors (in this case, being birthday mates) increased the rate of cooperation in a prisoner's dilemma. Along with Miller et al. we assume that similarity is likely to activate some sense of "belonging together" or belonging to the same category or group. Thus, also mechanisms of in-group bias which increase cooperation or decrease aggression are likely to be activated. In which social situations, under which conditions, and to what extent these processes work or do not work,

how important different sources of similarity are, and how they rule out or reinforce each other has to be the topic of further research. An interesting task might be, for example, if our hypothesis about the effect of similar social status not only holds in the case of anti-social responses as in our experiment, but also in the case of pro-social responses such as, e.g., helping others in a parking lot (cf. Hecht, 1991).

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Table 1: Median honking response time by status of frustrator and aggressor (group size and number of censored cases in brackets)

Status of aggressor	Status of frustrator: Lower	Status of frustrator: Higher	Total
Lower	7.1 (17;5)	4.9 (14;2)	5.8 (31;7)
Middle	7.4 (33;8)	6.4 (35;4)	6.4 (68;12)
Higher	6.0 (12;2)	6.4 (12;5)	6.2 (24;7)
Total	6.5 (62;15)	6.3 (61;11)	6.4 (123;26)

Note. Displayed are the median response times in seconds (linear interpolation from product-limit estimation).

Table 2: Multivariate analysis of honking response times (*z*-values in brackets)

	Model 1	Model 2	Model 3
Higher status frustrator	1.23 (0.95)	1.15 (0.68)	1.15 (0.67)
Middle status aggressor	0.79 (-0.91)		
Higher status aggressor	0.62 (-1.38)		
Small difference in status		1.38 (1.15)	
Large difference in status		2.00^{*} (2.15)	
Difference in status			1.42^{*} (2.16)
Female aggressor	0.56^{*} (-2.06)	0.64^{+} (-1.64)	0.64^{+} (-1.64)
Young aggressor (18 thru 30)	1.30 (0.88)	1.46 (1.28)	1.45 (1.27)
Old aggressor (over 55)	1.55^{+} (1.70)	1.71^{*} (2.03)	1.72^{*} (2.07)
Likelihood ratio: χ^2 (*df* in brackets)	10.82^{+} (6)	13.54^{*} (6)	13.52^{*} (5)

Note. Displayed are the exponents of the estimated coefficients of the Cox regression. Subtracting 1 denotes the percentage change on the hazard rate. However, *z*-values are calculated from the natural coefficients. Reference group: Lower status frustrator and lower status male aggressor between 31 and 55 years old. $N = 123$, 26 censored, $^{+} p < 0.10$, $^{*} p < 0.05$.